



# Status of the software and the infrastructure in Muon Collider



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# The new release: basic concepts



Muon Collider Software v.2.8, delivered in April 2023

The reference Linux distribution is Alma Linux 9  
CentOS 8 and CentOS 8 Stream are deprecated and not supported anymore

Main external dependencies updated  
to the latest versions

Updated all the components in  
common with ILC Software

Package	Version
ROOT	6.28
GEANT4	11.1
DD4hep	1.25
PandoraPFA	4.2
ACTS(*)	13.0
* Used older version for back compatibility	

# The new release: new features



New component (MuonCVXDDigitiser) is available for the digitisation of the vertex barrel.

Processors	
MuonCVXDDigitiser	SiDet simulation, quantisation, shape analysis
MuonCVXDRealDigitiser	Complete FE simulation (chipset, time)

New sets of geometries for the Muon Collider detector have been [published](#)

Geometries are version-ed according to a 3-numbers schema:

- Major version: baseline geometry
- Minor version: only back-compatible changes, no GEANT4 re-processing required
- Patch version: experimental variation of the baseline geometry

All the geometries have been moved in lcggeo, first step for migrating to key4hep

# The new release: other changes



## Changes for MarlinTrkProcessor

- FilterTracks processor to filter tracks
- Improved efficiency of DoubleLayer filter

## Bug fixes for

- ACTSTracking
- LCTuple

New python implementation for the tool anajob in LCIO

## Components removed from the Muon Collider Software

- BBQ
- Clupatra
- CondDBMySQL
- FcalClusterer
- ILDPerformance
- LCCD
- LICH
- Pathfinder
- Physsim

For further details <https://confluence.infn.it/display/muoncollider/Releases+notes>

# The new release: build and distribution



The build system/continuous integration is still based on ILC Software tools  
We plan to move to spack as a part of the migration to key4hep

The Muon Collider Software is distributed in the following ways:

- A docker container published in <https://hub.docker.com/r/infnpd/mucoll-ilc-framework> and in the CERN CVMFS
- An apptainer image published by INFN <https://xfer-archive.cr.cnaf.infn.it:8443/muoncoll/SoftwareReleases> (\*)
- A set of RPM packages for Alma Linux 9 <https://nexus.pd.infn.it/artifacts/repository/repo-files/mcsoft.repo>

\* OpenID Connect token required

# Software development: ongoing tasks



Migration to key4hep:

- Software management based on spack
- EDM4hep model for Muon Collider workflow
- Analysis of Gaudi framework (multithreading support)

Definition of a release validation workflow

For a thorough description of the tasks see the next presentation



# Available resources

## CloudVeneto

Openstack based cloud infrastructure operated by INFN-Padova

Computing	200 VCPU, 740 GB RAM, 100 Virtual machines
Storage	90 Tb on volumes, 75 Tb on object storage (Ceph)
Platforms	Docker, Kubernetes, batch clusters on demand
Access	INFN Identity Provider (INFN-AAI)

## INFN-CNAF Tier-1

Grid resources managed by INFN-CNAF

Computing	6 Computing Elements HT-Condor based
Storage	150 Tb on Storage element (StoRM)
Access	VO muoncoll.infn.it + IAM, CE only for INFN people

# Available resources



CERN site	
Computing	Computing Element HT-Condor based
Storage	100 Tb on EOS, 300Gb on CVMFS
Access	CERN SSO

INFN-Cloud	
PaaS solution operated by INFN	
Computing	Not yet assigned
Storage	300 Tb required
Access	INFN IAM (under testing)



# Issues for a common infrastructure



Many identity and access control architectures:

Standard	Comment
X509 VOMS proxy certificates	Specific for grid resources, ongoing replacement with new standards
Kerberos	Mainly for CERN resources
OpenID Connect / SAML v.2	Emerging standards, adopted by different cloud infrastructures

Resources are not federated, different accounts are required on different sites

Many sites belong to [eduGAIN](#) but it is not enough for the enrollment process

# Issues for a common infrastructure



Many architectures for the data management:

Standard	Comment
SRM v.2	Specific for grid resources, ongoing replacement with new standards
S3 and object storage	Emerging standards, adopted by different cloud infrastructures
HTTPS/WebDAV	Interfaces available for many storage systems

Many paradigms for the computing: batch systems, IaaS, PaaS

Containers can be used in most of the situations

# References for feed-back



Software – user guide and releases

<https://confluence.infn.it/display/muoncollider/Software>

Computing infrastructure

<https://confluence.infn.it/display/muoncollider/Computing+Infrastructure>

Wiki site – tutorial and papers

<https://mcdwiki.docs.cern.ch/>



Thank you for your attention

Any questions?